ME 1838

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REVISED
JANUARY 12, 1968

Instruction Manual

ELECTRONIC AND INERTIAL INSTRUMENTATION FOR MEASUREMENT, SIMULATION, CONTROL

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INSTRUCTION MANUAL

MODEL 1926A

Amplifier Plug-In

68-03-25-09

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ERRATA

MODEL 1926A Plug-In

There is an error in the Parts List in this manual.

In the 16th line of the top-half of the list, a resistor, SD Part Number R5021 (150Ω nom., 1/4-watt) is shown as Schematic Reference R106 in the A Amplifier.

The Schematic Reference should read R107.

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1 GENERAL DESCRIPTION

1.1 INTRODUCTION

The Model 1926A Plug-In Amplifier converts a Systron-Donner Model 1037-44 Electronic Counter into a time-interval counter with a resolution of 0.1 microsecond. Measurements of period, pulse width, pulse spacing and time interval between electrical events, such as delay time, are made precisely -- even where the events occur in different circuits. Time is read directly on the counter with the position of the decimal point and the time unit (μsec, msec, etc) clearly shown.

The amplifier used in both the "A" and "B" channel is virtually the same. It features AC or DC input coupling, five-step 100:1 input attenuation, variable trigger-level control for precise selection of the point on the input waveshape which is to cause triggering, a marker output signal to facilitate the selection of trigger level, and a slope selector to enable triggering with positive or negative going waveforms.

A "SEParate-COMbined" switch allows start-stop triggering on the same slope of one input signal but at two different amplitudes. In other words, the 1926A can be used as an amplitude discriminator.

2 SPECIFICATIONS (With Model 1037-44 Counter)

Time Interval: 1 μsec to 10^8 seconds

Timing Resolution: 0.1 μsec

Input Voltage: 0.3 peak-to-peak minimum (typically 0.1 v peak-to-peak)

Input Impedance: 1 MΩ shunted by 40pF in 1 and 3 "RANGE" positions
10 MΩ shunted by 40 pF in 10, 30 and 100 "RANGE" positions

Input Coupling: AC (0.1 μF series) or DC, switch selectable

Trigger Level: Continuously adjustable from +300 to -300 v peak-to-peak

Attenuation Ratios: 1, 3, 10, 30, 100 :1

Trigger Slope: Positive or negative, switch selectable

Marker Outputs: A and B Channel Marker output available on front panel. Output is a rectangular waveform corresponding to the frequency of the input signal. The leading edge of the marker signal, when superimposed (using a dual-trace oscilloscope) on the input waveform, indicates the point on the input waveform where triggering will occur.

3 INSTALLATION

The 1926A Plug-In Amplifier is installed in the 1037-44 Counter by sliding it into the plug-in cavity on the right side of the counter's front panel. A thumb screw located just to the left of the cavity secures the plug-in amplifier.

4 OPERATION

4.1 GENERAL

Inputs to the Model 1926A are designated "A" and "B". The "A" input will start count; the "B" input will stop it. The input connectors are located on the plug-in's front panel.

4.2 TRIGGER LEVEL AND SLOPE CONTROLS

Both inputs are provided with Trigger Level and Slope Controls. The Trigger Level Control determines the amplitude of the input signal which will start ("A") or stop ("B") the count. The Slope control determines the polarity of the input signal which will start or stop the count.

Adjustment of trigger level is greatly facilitated by using the marker output signals and a dual-beam or dual-trace oscilloscope. The marker signal is a rectangular wave whose leading edge occurs at the exact instant of triggering. By superimposing the marker signal on the input waveform, it is possible to easily adjust the Trigger Level and Slope controls so that triggering occurs exactly when desired. Figure 4-1 shows such a dual-trace presentation. A 10 KHz sine wave is being fed to input "A" and the trigger-level control is adjusted to cause triggering at the positive peak of the input signal. Figure 4-2 shows the same input signal but with triggering at the zero cross-over point just before the wave goes positive.

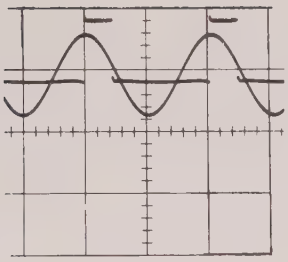


Figure 4-1. Marker output superimposed on 10 KHz sine wave input. Triggering at positive peak of sine wave.

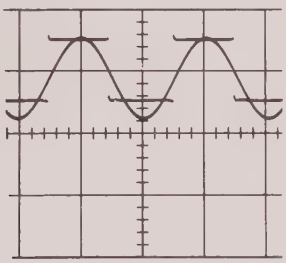


Figure 4-2. Same as Figure 4-1 except that triggering has been adjusted to occur at positive-going zero-cross-over.

4.3 TRIGGER LEVEL HYSTERISIS

It will be noticed that the Trigger Level Control settings for positive and negative slopes do not exactly coincide. This is due to a slight electrical hysterisis in the triggering circuitry. Maximum hysterisis is specified at 0.3 volts peak-to-peak -- thus the minimum input signal level will be the same value. Typically, though, the hysterisis will be closer to 0.1 volts peak-to-peak.

4.4 USE OF THE "SEP-COM" SWITCH

A switch labeled "SEP-COM" is located at the bottom of the front panel. In the "SEP" position, the two inputs are separated and the amplifier operates as described above.

In the "COM" position, an input to Channel "A" also appears at the input to Channel "B". The Channel "A" Trigger Level and Slope controls select the point on the input waveform which will start the count; the Channel "B" controls select the point on the same waveform at which the count will be stopped. Thus in the "COM" position, the plug-in can be used as an amplitude discriminator and to measure rise and fall times.

4.5 CONTROL SETTINGS FOR MAKING VARIOUS MEASUREMENTS

Measurement techniques and control settings for the 1926A are naturally inter-related with the counter with which the 1926A is used. The Model 1037-44 Counter Instruction Manual contains complete information on Model 1926A control settings and measurement techniques.

5 CIRCUIT DESCRIPTION

5.1 INPUT ATTENUATOR

The input attenuator includes five divider networks of either 10 megaohms, or 1 megaohm impedance, by-passed by 50 pf. Adjustable trimmer capacitors are provided for frequency compensation. These are factory-adjusted to obtain proper compensation with a square wave input. The input circuit of the amplifier has limiters which permit signals up to 500 volts peak-to-peak to be applied to the input terminals. The Trigger Level potentiometer adds a DC bias opposite in polarity to the sign indicated on the panel, to the amplifier input. When the DC level of the input signal is equal to the indicated trigger voltage, a triggering pulse is produced at the amplifier output.

5.2 D. C. AMPLIFIER SECTION (Refer to Dwg. 11111)

A "Nuvistor" tube is used in the input stage because of its high frequency response and input impedance characteristics. Limiting diodes CR101 and CR102 protect the tube from overload by limiting the grid to ±6 volts. The input stage, V101, functions as a cathode follower having very high input impedance and low output impedance for operation into the following transistor circuits. Q101 is an emitter-follower driving the amplifier stage Q102. Potentiometer R108 is the trigger zero adjust potentiometer. It is adjusted so that an output trigger pulse is produced when the input signal passes through zero volts and the TRIGGER LEVEL control is set as "0".

The amplified output of Q102 which may be a clipped waveform

whne a sine wave input is applied, drives the following Schmidt Trigger circuit, Q107 and Q108 thru emitter-followers Q103 and Q104 and the limiting network between them. This circuit has two stable conditions and is triggered from one state to the other when the signal voltage applied to it passes through a threshold level of approximately 0.65 volts in the positive direction or 0.25 volts in the negative direction, as measured at the collector of Q102.

The 0.40 volt difference between the positive and negative threshold levels, referred to as the hysterisis of the Schmidt trigger, is the minimum signal amplitude required to operate the trigger and is equivalent to much less than the rated input sensitivity for channels A and B (0.3 volts rms) at the input terminals. The output of the Schmidt Trigger is a squarewave, regardless of the input waveform applied.

The Schmidt Trigger drives two pulse transformers, T101 and T102. Q105 in the emitter circuit of the Schmidt Trigger provides a constant current source which compensates for the loading effect of the output transformers to help preserve the output square wave. Each output pulse transformer pro-duces duces a negative differential waveform. corresponding to either a positive-slope or a negative-slope on the primary, depending on which side of the center-tapped secondary winding is grounded by the SLOPE switch. These negative pulses are fed to the bases of Q108 (A^1 output) and Q109 (A^1 output) which amplify, invert and lengthen them. This is illustrated in Figure 1. The two output pulses from the "A" channel permit the start and stop channels to be operated by inputs

of different slopes. From the Model 1926 block diagram (Dwg. 11107), it can be seen that the A^1 output polarity is selected by the B channel slope switch. The B amplifier channel is identical to the A channel, except that it has only one output transformer.

6 MAINTENANCE AND CALIBRATION

6.1 AMPLIFIER LIST TIME ADJUSTMENT

a. Insert a Model 1926A into the counter and apply power. (Note: Always turn power off while changing plug-in units). Place the scope probe at test point 12 as shown in Figure 6-2.

b. Select "AC" coupling and an attenuation of "1". Apply a 1 Mc square wave signal with an amplitude of 1 V to the "A" input jack.

c. Adjust C4 of Figure 6-2 to obtain fastest rise time (best square wave form).

d. Switch attenuator to "3" and adjust C5 for best square wave.

e. Change scope probe to test point 13 and apply the 1 Mc square wave signal to the "B" input jack.

f. Select "AC" coupling and an attenuation of "1" and adjust C6 for best square wave.

g. Switch attenuator to "3" and adjust C7 for best square wave.

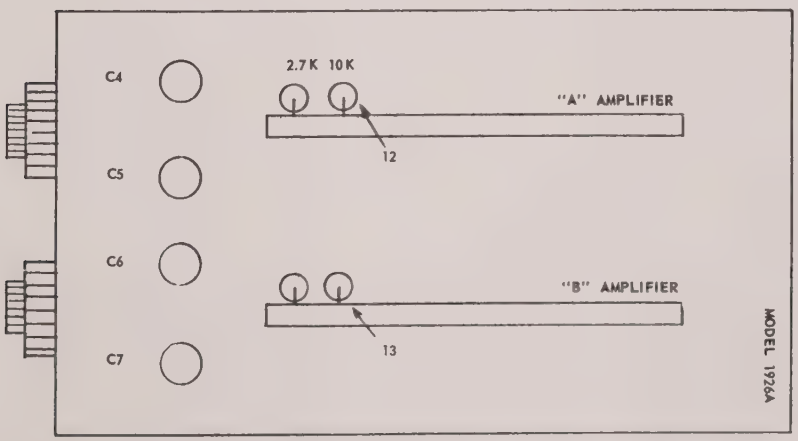
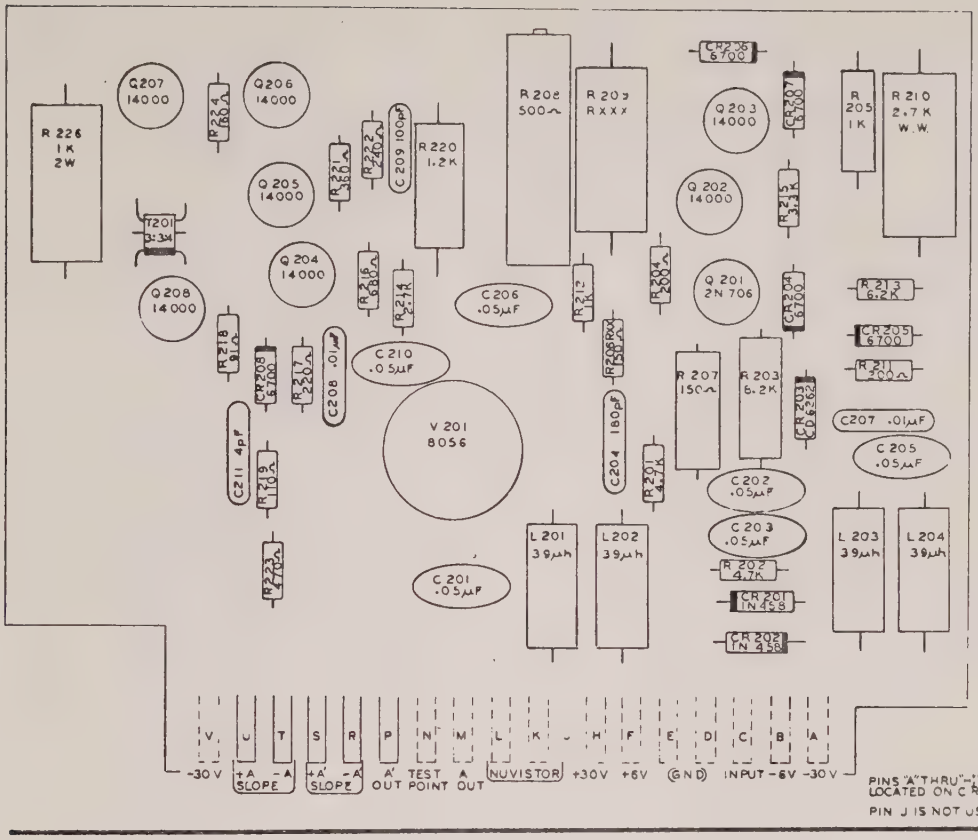
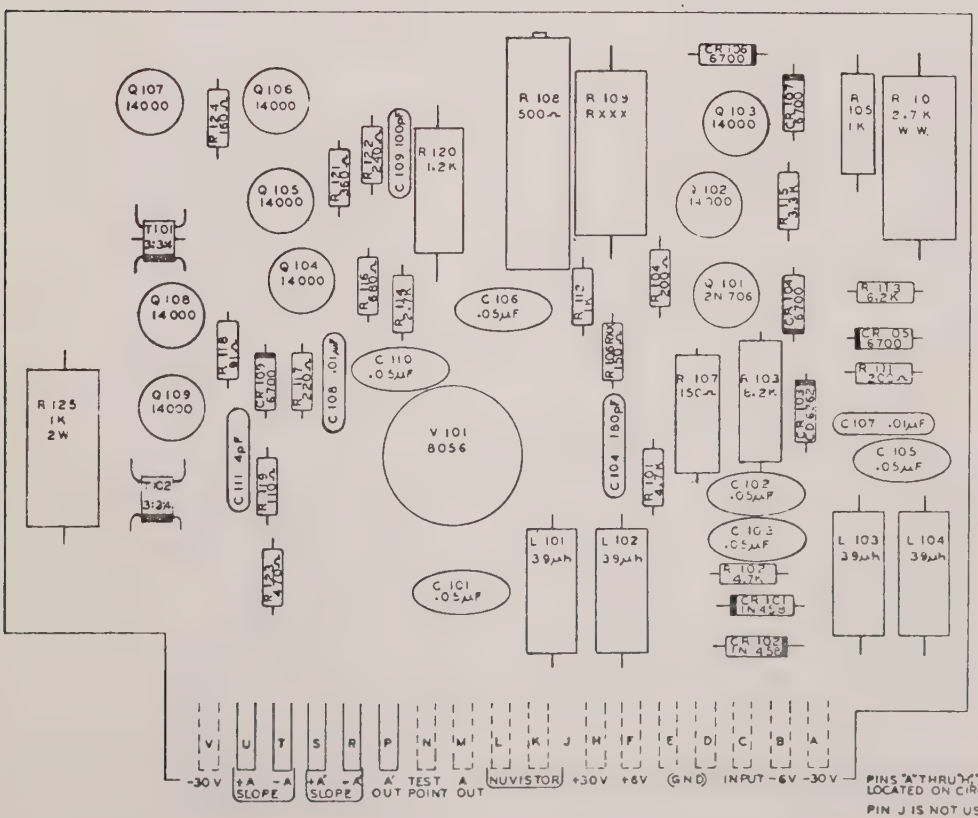


Figure 6.2 Testpoints and Adjustments for Period Input Amplifier (Model 1926A)

"B" Amplifier



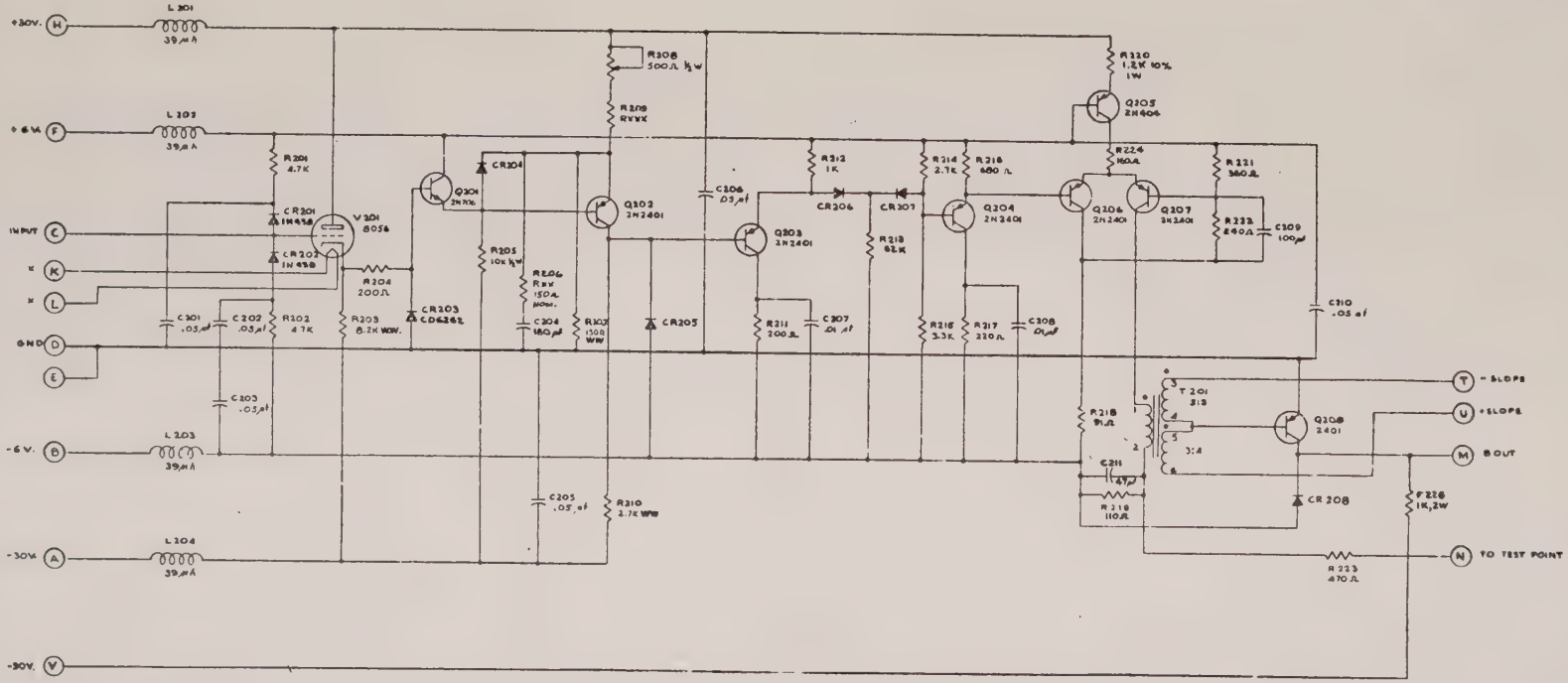
"A" Amplifier

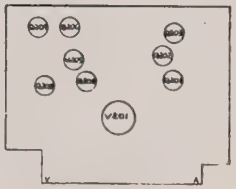


S-D Part No.	Description	REFERENCE A Amplifier	B Amplifier
C-0533	Capacitor, 47 pfd D.S.M.	C111	C211
C-0536	Capacitor, 100 pfd D.S.M.	C109	C209
C-0643	Capacitor, 180 pfd D.S.M.	C104	C204
C-0233	Capacitor, .01 u fd Disc	C107, 108	C207, 208
C-0708	Capacitor, .05 u fd Disc	C101, 102, 103, 105 106, 107	C201, 202, 203, 205, 206, 210
CR-0116	Diode, 1N458	CR101, 102	CR201, 202
CR-0150	Diode, CD 6262	CR103	CR203
6700	Diode, S.D. 6700	CR104, 105, 106, 107 108, 109	CR204, 205, 206, 207 208
L-0008	Choke, 39 u hy	L101, 102, 103, 104	L201, 202, 203, 204
Q-0055	Transistor, 2N404	Q105	Q205
Q-0130	Transistor, 2N706	Q101	Q201
19-14000	Transistor, 19-14000	Q102, 103, 104, 106 107, 108, 109	Q202, 203, 204, 206, 207, 208
R-1317	Trimpot, 500Ω, 1/2w, wire wound	R108	R208
R-1213	Resistor, 91Ω, 1/4w	R118	R218
R-1215	Resistor, 110Ω, 1/4w	R119	R219
R-5021	Resistor, 150Ω, (nom.) 1/4w	R106	R207
R-0983	Resistor, 150Ω, (nom.) 1/4w	R106	R206
R-1572	Resistor, 160Ω, 1/4w	R124	R224
R-0736	Resistor, 200Ω, 1/4w	R104, 111	R204, 211
R-0760	Resistor, 220Ω, 1/4w	R117	R217
R-0835	Resistor, 240Ω, 1/4w	R122	R222
R-1571	Resistor, 360Ω, 1/4w	R121	R221
R-1044	Resistor, 470Ω, 1/4w	R123	R223
R-0765	Resistor, 1K, 1/4w	R112	R212
R-1573	Resistor, 1K, 2w	R125	R226
R-0492	Resistor, 1.2K, 1w	R120	R220
R-1591	Resistor, 1.2K (nom.)3w W.W.	R109	R209
R-0937	Resistor, 2.7K, 1/4w	R114	R214
R-1579	Resistor, W.W.	R110	R210
R-0742	Resistor, 3.3K, 1/4w	R115	R215
R-0892	Resistor, 4.7K, 1/4w	R101, 102	R201, 202
R-0965	Resistor, 6.2K, 1/4w	R113	R213
R-1574	Resistor, 8.2K, W.W.	R103	R203
R-0292	Resistor, 10K, 1/2w	R105	R205
11348	Transformer	T101, 102	T201
V-0106	Nuvistor	V101	V201
X-0106	Socket, Nuvistor	--	--
11120	Amplifier "A" Assy	Schem 11111	Schem 11106
11140	P.C. Bd for Amp. "A" & "B"	Artwork 11141	Artwork 11141

PLUG-IN AMPLIFIER ASSEMBLY

S-D Part No.	Description	Reference
J-0261	Connector	Amphenol Blue Ribbon 57-10500
S-0110	Switch, DDPT	S2, S4, S5, S6, S7
J-0138	Bannana-Jack-White	
11637	Knob-Black & Red	RB 999-700
J-0260	Connector	BNC
E-0137	Ground Lub	BNC Type
J-0265	Connector	Viking VH 18/1AB5
H-0980	Screw - Phillips	4-40x1/4
H-0981	Screw-Hex HD-Self Tap.	4-40x1/4
H-1065	Screw - Phillips	4-40x1/2
H-0734	Washer, Cad Pl. Steel	#4
H-0441	Hex Nut	4-40
H-0951	Terminal Strip	Cinch 1540
H-0845	Ground Lug	
H-0453	#4 Tinnerman	
H-0954	Drive Rivet - 1/8 x 3/16	Southco #38-504-03
H-0404	Rivet - 1/8 x 1/8	
H-0758	Washer - #4 Flat	
C-0382	Capacitor .1 uf	C13, C26
R-0966	Resistor, 100Ω, 1/4w 5%	R14, R28
R-0259	Resistor, 2.2K 1/2w	R29, R30
R-1577	Resistor, 3.9K, WW	R6, R8, R20, R22
C-0708	Capacitor .05 uF	C5, C6, C18, C19, C27, C28
CR-0095	Diode, 1N751A	CR1, CR2
R-1045	Resistor, 2.4K, 5%	R31, R32
R-0466	Resistor, 100Ω, 1/2w 5%	R33, R34, R35
H-0745	4-40x3/8 FHMS	Pull - Front Panel
	Coax	
	Insulated Shield	
	Wire #22 GA - Stranded	
	Bussing	
	Wire #18 GA - Stranded	
1-11101	Support Cover	
1-15583	Pull - Front Panel	
1-13772	Front Panel	
2-11126	Welded Assembly Plug-In Amp	
2-11120	Assembly PC Bd "A" Amp	
2-11132	Assembly PC Bd "B" Amp.	
2-11134	Assembly A&B Range Sw.	
1-11124	Rear Plate	





"B" AMPLIFIER

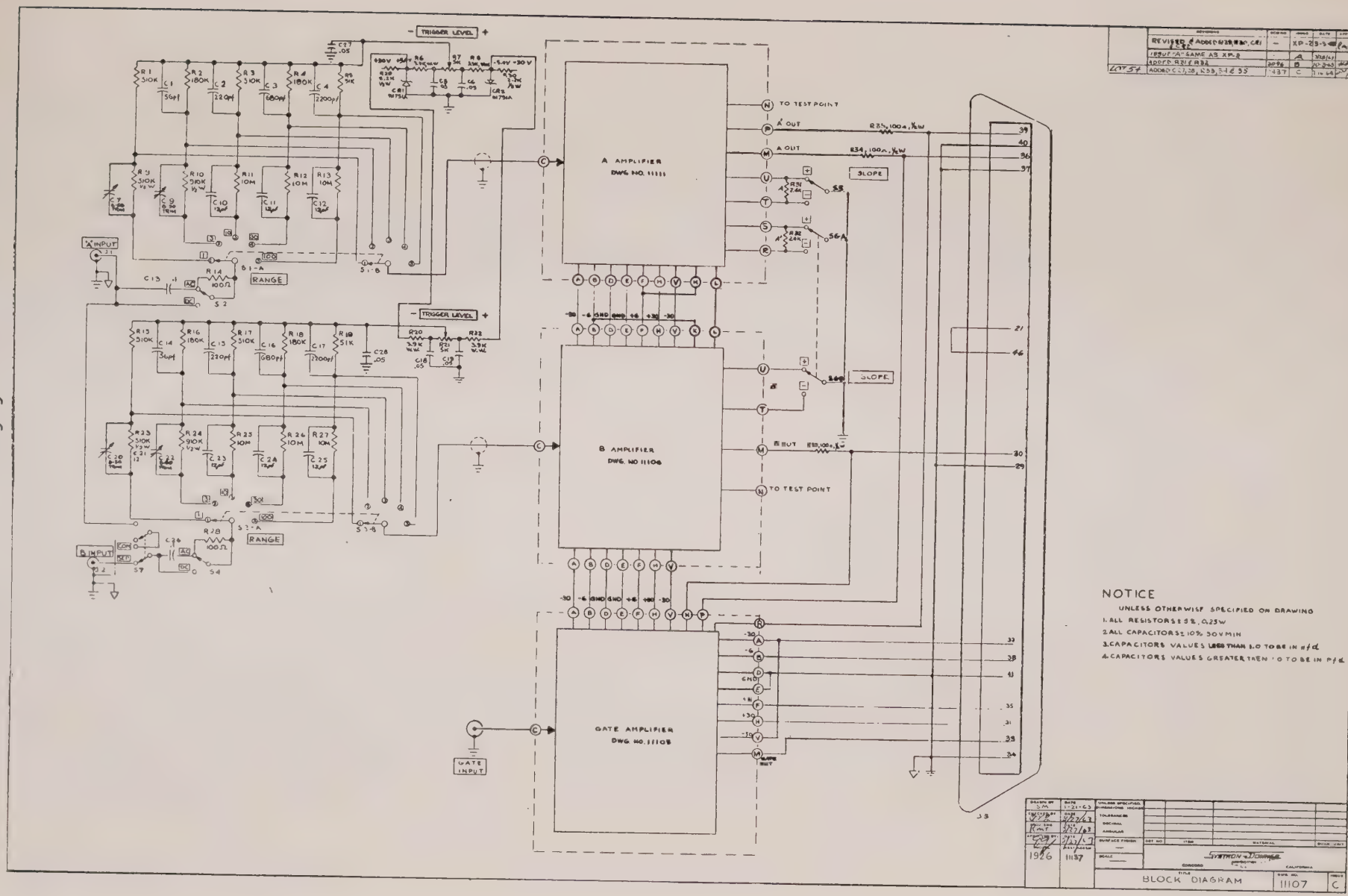
NOTES:

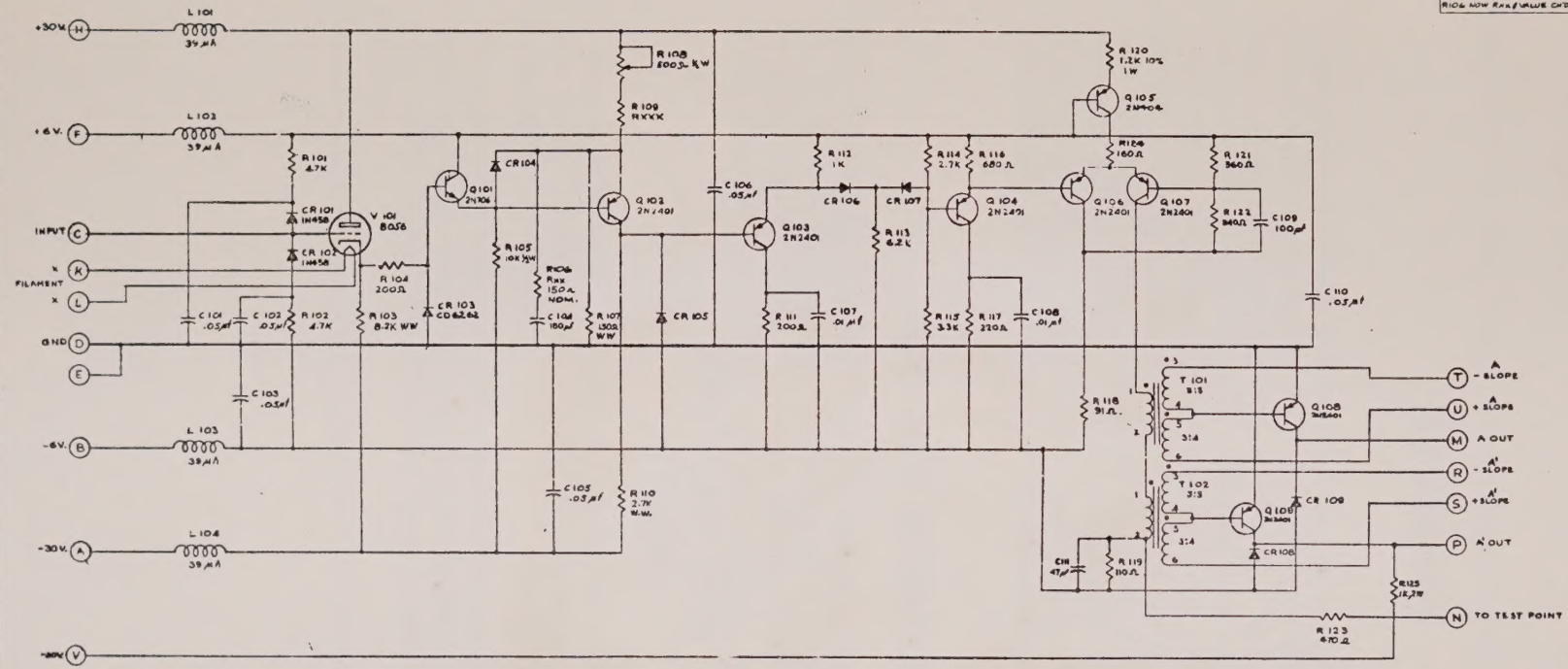
UNLESS OTHERWISE SPECIFIED ON DRAWING

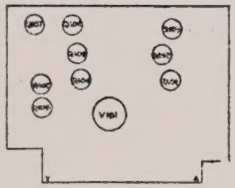
1. ALL RESISTORS ±5 %, 0.25 W
2. ALL CAPACITORS ±10 % 30V MIN
3. CAPACITORS VALUES LESS THEN 1.0 TO BE IN µµfd.
4. CAPACITORS VALUES GREATER THEN 1.0 TO BE IN µfd.
5. ALL DIODES PER SYSTRON DONNER CORP NO 6-6700
6. R209 IS SELECTED VALUE

REVISED & UPDATED	-	VP	2-25-63	
ISSUED AS SAME AS XP-7		A	3/4/63	
R209 WAS 500Ω, WW	2061	B	3-26-63	
E CORRECTION R209 & CR 3 VALUE	2091	C	9-9-63	

DRAWN BY SM	DATE 1-18-63		
ENGINEER BY	3/1/63		
CHK'D BY	3/5/63		
APPROVED BY	3/7/63		
1926	11132	"B" AMPLIFIER SCHEMATIC	11106 C


- TRIGGER LEVEL +
A INPUT
B INPUT
RANGE
A AMPLIFIER
DWG NO. 11111
B AMPLIFIER
DWG NO 11106
GATE AMPLIFIER
DWG NO. 11108
GATE INPUT
TO TEST POINT
A OUT
B OUT
SLOPE
NOTICE
UNLESS OTHERWISE SPECIFIED ON DRAWING
1. ALL RESISTORS ± 5%, 0.25W
2. ALL CAPACITORS ± 10% 50VMIN
3. CAPACITORS VALUES LESS THAN 1.0 TO BE IN μfd
4. CAPACITORS VALUES GREATER THEN 1.0 TO BE IN P/fd
BLOCK DIAGRAM
11107





"A" AMPLIFIER

NOTES

UNLESS OTHERWISE SPECIFIED ON DRAWING

1. ALL RESISTORS ±5%, 0.25 W.
2. ALL CAPACITORS ±10% 30 V. MIN.
3. CAPACITOR VALUES LESS THAN 1.0 TO BE IN μf'd.
4. CAPACITOR VALUES GREATER THAN 1.0 TO BE IN p f'd.
5. ALL DIODES PER SYSTRON DONNER CORP. SPEC. NO 6-6700
6. R108 IS SELECTED VALUE

REVISED & UPDATED	-	EP-2	3-6-63
ISSUE "A" RELEASED PER E.C.N.	-	A	7-26-62
R105 WAS 500Ω, WW	2061	B	7-26-62
REMOVED RESISTOR R126, 2W	2062	C	8-3-62
R106 NOW RMX VALUE CHG'D. PER E.C.N.	2091	D	9-4-62

DRAWN BY	DATE		
SM	1-10-62		
CHECKED BY	DATE		
	8/21/62		
ENGR.	DATE		
	1/21/63		
PROJ. ENGR.	DATE		
	1/23/63		
DRWG.	JOB		
1926	11120		
1925			

"A" AMPLIFIER SCHEMATIC

11111

WARRANTY

Systron-Donner instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes, except as they are warranted by tube manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense during such period and which has not been subjected to misuse, neglect, improper installations, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Systron Donner instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

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Please specify both model and serial number in all correspondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest sales representative or Sales Manager, Instruments, Systron-Donner Corporation, 888 Galindo Street, Concord, California.

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